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ABSTRACT

The campus data network, WABnet, at Wabash College (Crawfordsville, Indiana) provides students with access to the campus Novell servers, the library catalog, and the Internet. The College attempted to minimize the support load for the Intel-based PCs (personal computers) by developing a self-install procedure for student PC connections. The program was very successful, with more than 60% of students connecting without assistance from Computer Services. This paper discusses student support needs, and the challenges of meeting these needs. The self-install procedure, which lets students do everything from installing the network card to loading software, is described in detail. The ongoing post-connection support system, which includes a World Wide Web server and student employees, is also discussed. (Author/AEF)

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Supporting Student PCs on the Campus Network

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Introduction

In the summer of 1995, Wabash College extended its campus data network, WABnet, to all campus living units. WABnet provides students access to the campus Novell servers, the library catalog, and the Internet. While this connectivity is a great resource for the students, it carries with it a large support load. Intel-based PCs, which come in hundreds of configurations, can be particularly difficult to support. We attempted to minimize the support load for these systems by developing a self-install procedure for student PC connections. This program was very successful, with more than 60% of students connecting without assistance from Computer Services. The paper will discuss student support needs, and the challenges of meeting these needs. Our self-install procedure, which lets students do everything from installing the network card to loading software, will be described in detail. Our ongoing, post-connection support system, which includes a World-Wide Web server and student employees, will also be discussed.

Student Support Needs

In terms of needs, supporting student computers is not much different than supporting PCs in campus computer labs or staff offices. There certainly are additional challenges supporting student systems, but the basic needs are nearly identical. Like a college professor connecting to the network for the first time, a student needs access to an active data port, must install a network adapter, and load connection software and network applications. Once connected, a student will likely require some ongoing support, such as how to upgrade to a new version of Netscape, or what to do if he suddenly cannot connect. Generally some assistance will be required when a student changes rooms, but the same actions would be necessary if our professor changed offices. The primary difference in basic needs is that students will eventually disconnect their systems and move on, whether permanently upon graduation, or temporarily during a summer break.

The difficulty in supporting students is finding a way to meet these needs. A fully deployed student network can suddenly double or triple (or more) the number of computers on the network. It is unlikely that the support staff well enjoy similar growth, so the challenge facing college computer centers is how to "do more with less." The problem is compounded because most students want connected at the same time--as soon as they arrive on campus. Other factors, such as unfamiliar brands of computers, can make student PCs inherently more difficult to support than campus systems.

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Making the Initial Connection

Based on experiences at other institutions, we anticipated that the biggest support load would be in helping students make the initial connection to the network, and so our support efforts were focused there. After considering several plans used elsewhere, such as installation fairs and building-by-building mass installation sessions, we decided the best way to minimize our support load would be to have students make the connection themselves. Many students have added sound cards or other devices to their computers, so we thought that, given careful instructions, students could install the network card. Configuring the card and installing client software seemed a bit more challenging, and so would need to be automated as much as possible.

To this end, we designed the WABnet Connection Kit, which is sold through the college bookstore. Each kit includes a network adapter, patch cable, installation software, an installation manual, and a registration form. Several types of kits are sold to meet the needs of different computers; for IBM-compatibles, we sell a version with an Intel EtherExpress Pro card for desktops, and a version with a 3COM EtherLink III PCMCIA card for portables. Most of the work on creating the kits was done by two student interns, who worked on the project throughout the summer of 1995.

The installation manual[1] is a fourteen page guide that describes the connection procedure for both IBM-compatible and Macintosh systems. The guide lists minimum and recommended system configurations, briefly discusses different kinds of computers and what network adapters are needed, and describes the registration process. Four pages are devoted to the most difficult process: installing the network card. The guide then covers the software installation and customization procedures. Finally, the booklet outlines the support options in case a student has problems.

The registration form[2] is used to keep track of who is connecting to the network, and provides us the information needed to prepare the connection, such as which data jack the student will be using, and the ethernet address of his network card. The same form is used when a student makes the initial connection, and when a student changes rooms.

Installation software consists mainly of several DOS batch files which copy NetWare and TCP/IP client software to the student computer, and install application software such as Netscape. Specific tasks performed by these batch files are described below.

The student self-installation procedure is summarized as follows:

1. Student purchases WABnet installation kit in bookstore.

2. Student completes and turns in registration form to Computer Services.

3. Computer Services assigns IP address and enters information into DHCP/bootp server, and activates data port using remote management software.

4. Computer Services notifies student via e-mail that registration has been processed. Processing time is generally 24 hours. Once notified, the student can proceed with installation.

5. Student installs Intel card in any free 8-bit or 16-bit ISA slot, and attaches network cable. The installation guide offers help with this, and a video illustrating the process is also available.

6. Student boots computer, exits Windows, and runs INSTALL program on the installation disk. This batch file installs network access batch files to the C:\BAT directory, installs network drivers to the C:\NET directory, adds the BAT directory to the path, attaches the computer to NetWare server, and calls the WABINSTL batch file, which is located on server.

7. If INSTALL was able to complete all of its tasks, WABINSTL changes WIN command to WINNET in the AUTOEXEC file, copies Windows NetWare client software to the Windows directory, unzips WABnet-ready Internet software (Winsock, Netscape, telnet, ftp, Pegasus Mail) to the C:\WABNET directory, and run Windows, calling Netscape setup program.

8. In addition to installing Netscape, the Netscape setup script was customized to modify the Windows setup to provide NetWare support, connect a network printer to LPT2:, create a WABnet program group, and add Internet applications.

9. The student customizes application software such as Pegasus Mail and Netscape, to include such items as his personal name and e-mail address.

Several steps warrant further discussion. In step 3, Computer Services staff activates the data port, and builds a DHCP/bootp entry for the computer. For security reasons, all data ports in student rooms are disabled using SNMP management software. When a student registers to use a data port, that port is activated remotely. Using this management software, we can control the state of all ports without going to the hub, which saves a great deal of time.

All TCP/IP information (IP address, name servers, etc.) is provided via DHCP/bootp to simplify the connection process. By providing this information via a central server, the student does not need to know (or enter) this information when making the initial connection, nor does he need to change anything when switching rooms. The key piece of information the student must provide is his ethernet address. To make it easier to provide this, we write the address on the outside of the WABnet Connection Kit. It is worth mentioning that the TCP/IP stack included with Windows 95 does not support the bootp protocol, but requires a DHCP server.

The video mentioned in step 5 is a short, ten-minute video produced entirely by our two summer student interns. The video steps through the process of installing the network card--the students open a PC, locate the expansion slots, install the card, and show how to connect the cable. This summer we plan to expand the video to show the software installation, and include some basic troubleshooting tips.

Steps 6 through 8 cover the software installation procedure. From this point on, each step is performed only if the previous step was completed successfully. For example, step 7 involves running a batch file located on the file server; this will run only if the computer made a connection to the server. The key benefit of such a solution is that it is nearly impossible for the student computer to be left unusable or unstable if the installation fails. If problems occur the student will

not have a network connection, but at least his computer will operate as before. This gives the support staff the freedom to schedule visits to student rooms at their convenience, rather than having to react immediately to fix a problem caused by the installation program.

We expected that some students would not want to do the installation themselves under any circumstances, but given the time invested in developing the self-install procedure, we did not want to encourage this. We decided to give the students the option of having Computer Services staff perform the installation, for a nominal fee of $20 (our normal minimum fee for working on non-college systems is $35). With this arrangement, those students who were fearful of opening their computers had a viable way to connect, but the vast majority of students were led to try the self-installation.

Resolving Problems

As mentioned previously, 95% of our students attempted the installation, and for 60% the installation was completely successful. A variety of factors can prevent the process from working. Hardware conflicts between the network adapter and other cards--particularly sound cards--was a common problem. A computer that loads a lot of TSRs to support sound cards, CD-ROMs, and virus protection can suddenly experience memory problems once network drivers are added to the mix. We encountered a third problem because the install program expected the first network drive to connect as F:. If it connected using another drive letter, the install program failed. Another common problem, ironically, was with systems with plug and play (PnP) BIOS. The Intel card is a PnP device, but some PnP systems either configured the card incorrectly, or were unable to manage it.

Students who had installation problems would call or e-mail the student-run help desk. As long as the student installed the network adapter and ran the install program, free support was provided to make the connection. The help desk would go through some basic troubleshooting steps, then arrange for a visit to the student room if the problem could not be resolved. If the student assistants could not correct a problem, it was referred to Computer Services staff. We discovered that most problems required help from professional staff. A more complete discussion of our successes and failures of student employment can be below in the section Residential Networks and Student Employees.

A great advantage of the automatic installation procedure was that it helped to minimize support time, even if the process was unsuccessful. In all but a few cases, students were able to install the network card, so little effort was spent on this time consuming task. Also, support staff could quickly narrow down the cause of the problem by checking to see at which point the installation failed. If, for example, the automatic installation failed to load the network driver, the problem was likely caused by a hardware conflict. Memory and startup file problems have similar key indicators. As little time was wasted finding the causes of problems, they were resolved more quickly. After fixing a problem, support staff simply restarted the installation program at the point it failed.

The biggest problem we had with our automatic installation procedure was caused by Windows 95. Although we had obtained a beta release of this software and tested its networking capabilities throughout the summer, the final version was released only five days before classes started. With the late release, we were unable to develop installation software, or even installation instructions,

for Windows 95 before students started connecting. Because of this, support staff had to manually configure network access for those students who upgraded early in the semester. Basic installation instructions were developed during the fall, but did not have the ease or quality of the Windows 3.1 set. Improving Windows 95 support will be a primary focus of our summer activities.

Continuing Support Offerings

Connecting student computers is almost certain to be the biggest support load, but does not signal the end of the support needs. Some students may develop problems with their connections, and all students will need to update their application software as new versions are released. Computer Services will likely need to get information to students on a regular basis, such as when network maintenance is scheduled or what problems are affecting network access or performance.

The WABnet InfoSource[3], a World-Wide Web server, has been used as a primary source of ongoing support. The main server page contains links to seven areas of information. The News and Notes section is used to list network announcements, down times, and trouble reports. The General Information page discusses the features and benefits of WABnet, contains usage guidelines, and offers an overview of the network. WABnet Support Information tells how to connect, disconnect, and everything in between. The ever popular WABnet File Archives section provides a local download source for popular software, and also contains links to off-site repositories. The Expansion Page was used to provide updates on the progress of the network expansion to the dormitories; now that the expansion is finished, this section will soon move to the General Information or News and Notes section. We maintain a list of networking resources at other institutions, as well as home pages of the companies whose products are used for WABnet, on the Links to Interesting Places page. Finally, the Telephone Information page is a source for a variety of information about our campus telephone system.

Maintaining a web site is a time consuming undertaking, but worthwhile. Providing a one-stop resource for all networking information lets users find help easily; perhaps while browsing they will find something else they can use, but never thought of. The Web can be used to distribute announcements, support information, and file updates. It allows easy access to off-site resources, such as computer vendors or software companies. The Web even provides an easy way to getting information from the user, through the use of forms. Also, having an Internet-based support site allows users around the world (including prospective students) to see what is available at the college.

Continuing problems were resolved as initial connection problems were. A student having trouble would call the help desk, and the problem would be filtered up the support chain until resolved.

Leaving the Network

Sooner or later, all student computers will leave the network and be used again as stand-alone systems. For many students this may occur twice or more each year. Two objectives are important in these instances. First, as much as possible the student computer needs to be restored to the state it was before connection. Probably connection and application software should not be deleted from the hard drive, but network drivers should not be loaded, nor should the student be bombarded with warning messages that a network was not found. The second, sometimes competing objective, is

that the system must be easily reconnected to the network when brought back to campus.

Support Challenges

Many factors can make supporting student-owned PCs more challenging than supporting computers in college computer labs or faculty offices. Understanding, and overcoming, these challenges is essential to providing effective support. The primary difficulty is likely to be supporting the wide range of brands and models that students own. Further problems can arise from the unusual configurations, such as multimedia systems or different operating systems, that many students have. Ongoing support is complicated because support personnel have no control, or even influence, over how systems are modified or upgraded. Students change rooms, which requires action by the network manager. Finally, supporting systems in a different environment--the student dorm room--is a challenge itself.

The wide range of computer brands and models provides the biggest challenge in supporting student-owned PCs. At Wabash, we can dictate that all college-owned PCs are of a particular brand. With this arrangement we become very familiar with the hardware and software intricacies of that brand, and our support load is minimized. We do not enjoy this luxury with student computers, however. Instead of supporting one brand, we are supporting more than twenty name brands, plus many nameless clones or homemade systems. This presents many difficulties to those supporting student systems.

Unfortunately, the range of brands is only half the problem. Student computers have an incredible range of configurations. Some students have slow, underpowered "hand-me-down" systems, which were sent to school when the family PC was upgraded. Other students have high powered multimedia systems, complete with tape backup, zip drives, surround sound speakers, and video capture boards. Support personnel must be able to providing functional network connectivity on all types of systems--a prospect which can be as difficult on loaded 133mhz pentium systems as on 386SX computers with 4mb RAM and 40MB hard drives.

Other challenges arise from not having control over student systems. For college systems, we can reasonably dictate what peripherals and additional hardware can be installed, which operating systems are used, and which application software will be supported. With student systems, we lose this control. A student may decide to install a new sound card or zip drive, download a beta release of Netscape, or upgrade to Windows 95. Often these changes affect network access.

At Wabash many students, particularly freshmen in fraternities, may change rooms frequently. Each time a student moves, his old network port must be disabled, and the new port activated. If the student changes buildings, his IP address information must be updated as well. While these changes are not insignificant, the time requirement is not substantial. Student movement is currently tracked using the WABnet Registration Form; next year we hope to allow students to report a move via a Web form.

The environment of student PCs creates a special set of challenges. One problem is location. At Wabash, like many schools, student living units are located at the outer edges of the campus. Support staff may spend significant time just in going to and from student housing. After reaching

a building, working on a computer in a student room can be challenging. Cluttered rooms, pets, roommates, noise, and lofts can create undesirable working conditions--trying to diagnose a problem while dogs are yapping, music is blaring, or roommates are fighting is problematic, to say the least.

Overcoming the Support Challenges

In our support policies we have tried to adapt to the student environment, rather than dictate what is acceptable for student systems. Nevertheless, some controls are necessary to ensure that student needs are met; there is, after all, a limit to how much time can be spent connecting student computers. Such controls needed to simplify our support, while allowing students as much flexibility as possible.

One firm requirement is that all students must purchase a WABnet Connection Kit to receive any support. In a few isolated incidents, a student purchased a different network card or owned a PC with a built-in network adapter. We allowed the connection but would not offer any help with installation; in all but one case the student ended up purchasing a kit from the college. Also, we have limited support to DOS, Windows 3.x and Windows 95 systems. A number of students run Linux, but depend on each other for support. Finally, we do not support beta software releases. Beta releases are problematic particularly with Internet access software such as Netscape, because they are readily available, but are not always stable.

There is no easy way to overcome the problems caused by different brands and configurations of student computers. Only time and experience will address this. The best way to minimize this problem is for support staff to document (and communicate to others) the solutions to problems. All problems are likely to be repeated, and there is nothing more frustrating than having one support student tell another about a problem, only to be told that the second person had seen the same thing only two days earlier! In some cases, support staff may need to refer the student to the system manufacturer for assistance. We had one case where we could not get a Windows 95 system to recognize the sound card once the network adapter was installed, even though the two boards had no hardware conflicts. The vendor quickly told the student that under such a configuration, a different sound driver had to be installed. This and similar problems are virtually impossible for support staff to solve without vendor support. Ultimately, if a problem cannot be resolved, support staff must be empowered to tell a student that the computer simply cannot be connected, given its current configuration. Hopefully in these situations the support staff can at least give the student some options for connection (such as removing that odd answering machine board that uses four interrupts).

One problem we did not handle well was getting caught up in general student PC support. Many students seem to be of the opinion that once they connect their computer to the campus network, the college will provide free, immediate, and effective service for any problem they might encounter, whether or not the problem is related to the WABnet connection. Hardware upgrades can cause interrupt conflicts. Installing games and other software can overwrite the AUTOEXEC.BAT file, modify Windows settings, or cause RAM shortage. Upgrading operating system software can mean nothing works. Such system changes very well may affect network access or performance, but is this a network problem? Usually not.

This problem has led us to modify our support policies for the coming school year. We will continue to provide free support to establish the initial connection (provided the student has installed his network card). We will also offer free support during the first week or two of connection, in case the student discovers any problems that were missed during the setup. However, after the initial free support period, any student needing assistance will be required to bring his system to us, and pay for support.

Residential Networks and Student Employees

Residential Computer Consultants (RCCs), students hired to help support the student network, were a critical part of our initial support plans. During the fall semester we employed ten RCCs. These students ran the help desk, answering trouble calls and e-mail, and worked on problems on-site.

We discovered early in the semester that the RCCs were able to solve few of the problems students were having. There were probably several reasons for this. The primary reason was that many of the problems which caused the automatic installation to fail, such as hardware conflicts or memory issues, were difficult to solve, and beyond many of the RCCs' technical abilities. Training was complicated by having so many RCCs; it was also hard to justify extensive training of students who worked only five or ten hours per week. In the end, we realized that the systems the RCCs could help with were being set up without help by the students themselves. In this respect, the self-install procedure was working too well!

For the spring semester, only two students were hired as RCCs (first semester RCCs were rehired as computer lab operators). With only two RCCs, these students were able to work more closely with Computer Services, and were trained to solve more difficult problems. The students also took on some of the maintenance tasks of the WABnet InfoSource web server, which gave them something productive to do during periods of low support needs. We plan to continue with this model next year.

Conclusions

One year into residential network connectivity at Wabash, we are convinced that student PCs can be supported, with reasonable impact on support staff. Our self-install procedure has worked very well; by incorporating into our procedures what we have learned this year, we hope to raise the success rate to over 75% next year. We are also very pleased with the success of the WABnet InfoSource, and will develop and promote this resource even more heavily next year. Finally, by refining our student employment, we will be able to shift even more support away from professional staff.

NOTES

1. The complete installation booklet is available in Adobe Acrobat (.PDF) on the Internet at http://jade.wabash.edu/wabnet/support/instalgd.pdf
2. The complete registration form is available in Adobe Acrobat (.PDF) on the Internet at http://jade.wabash.edu/wabnet/support/regform.pdf
3. The WABnet InfoSource is open to all Internet users, and can be found at http://jade.wabash.edu